College of Veterinary Medicine
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Antibiotic Susceptibility Profiles and the Important Role They Play in the Survival of Dogs with Septic Peritonitis

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Introduction

Canine septic peritonitis is inflammation of the peritoneal cavity secondary to bacterial contamination and infection.[1] Inflammation of the peritoneal cavity is most commonly the result of intestinal perforation due to foreign bodies, administration of non-steroidal anti-inflammatory drugs, neoplasia, or dehiscence of previous surgical sites.[2, 3, 4] Other sources of bacterial contamination include the biliary tract, urogenital tract and trauma to the abdomen.[5,6] Clinical signs of dogs with septic peritonitis include peritoneal effusion and abdominal pain. Most animals with septic peritonitis are systemically ill and exhibit nonspecific clinical signs such as anorexia, vomiting, mental depression and lethargy.[4] While diagnostic imaging findings consistent with abdominal effusion or the presence of pneumoperitoneum are good evidence of septic peritonitis, a diagnosis is based on abdominocentesis or diagnostic peritoneal lavage and analysis of the fluid sample for presence of toxic neutrophils with intracellular bacteria.[1, 5] Comparison of glucose and lactate concentrations with concentrations of those analytes in a concurrent serum or plasma sample can also be performed to substantiate diagnosis of septic peritonitis.[7] Obtaining microbial samples from the peritoneal cavity for culture and susceptibility testing is typically done later, at the time of surgical intervention. Canine septic peritonitis is a challenging disease process to treat, with survival rates reported between 54% and 79%.[8] Recognition and early, aggressive intervention and supportive care are key to the treatment of sepsis.[a., 2,9] The single most important predictor of survival in sepsis is prompt administration of an effective antibiotic to which the offending bacterium is susceptible.[8] It has been documented that inappropriate empirical antimicrobial selection is associated with a prolonged hospital stay and worse prognosis in patients with sepsis.[a.] This study focused on identifying the most prevalent bacteria and antibiotic susceptibility profiles involved in canine septic peritonitis cases at the University of Missouri Veterinary Medical Teaching Hospital (VMTH). **We hypothesized that the majority of dogs with septic peritonitis that died or had euthanasia performed were initially given an antibiotic to which the bacteria were not susceptible**.

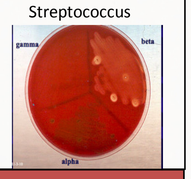
Methods

The antibiotics administered were segregated into three groups: (1) Presurgical (defined as antibiotics administered prior to arrival at the VMTH or at the VMTH beginning greater than one hour prior to surgery), (2) Perioperative (defined as given less than or equal to one hour prior to surgery and during the surgical procedure) and (3) Postoperative (defined as given after completion of the surgical procedure). The postoperative antibiotic group was subdivided into (a) dogs that had suitable antibiotics given presurgically, perioperatively, and postoperatively and (b) dogs that had unsuitable antibiotics given presurgically and perioperatively but changed to suitable antibiotics postoperatively. We compared the number of survivors versus dogs that died or had euthanasia for each of the above antibiotic treatment groups and subgroups.

Escherichia coli

Enterococcus spp

Streptococcus

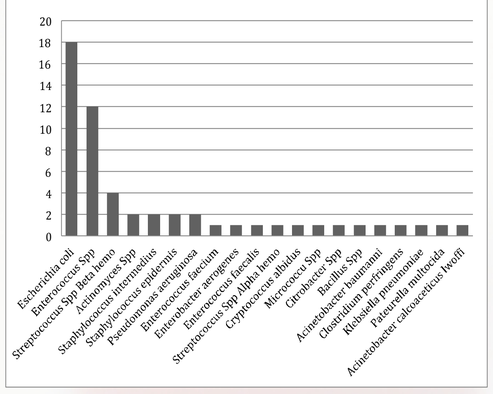


Results

Table 1. Bacterial Susceptibility to Pre-surgical, Peri-operative and Post-Operative Antibiotics Administered to 16 dogs that Survived and 12 Dogs that died with Septic Peritonitis

Case	Pre-Surgical	Perioperative	Post-Operative	Outcome
1	O	O	O	alive
2	O	O	O	alive
3	O	O	O	alive
4	X	X	O	alive
5	X	O	O	alive
6	X	#	O	alive
7	#	O	O	alive
8	#	O	O	alive
9	#	O	O	alive
10	#	O	O	alive
11	#	O	O	alive
12	#	#	X	alive
13	#	X	O	alive
14	#	O	X	alive
15	#	O	O	alive
16	#	O	O	alive
17	O	O	O	dead
18	O	O	O	dead
19	X	X	X	dead
20	X	X	O	dead
21	X	O	O	dead
22	X	X	#*	dead
23	X	X	X	dead
24	#	#	#	dead
25	#	O	O	dead
26	#	O	O	dead
27	#	O	#	dead
28	#	X	X	dead

Figure 1. Distribution of Bacteria Cultured from Interoperative Samples from 28 Dogs



O- Administered suitable antibiotic to which the bacteria were susceptible
X- Administered an non-suitable antibiotic to which the bacteria was not susceptible
#- No record of antibiotic administered
#*- Died before entering ICU

Table 2. Percent of Suitable and on-suitable Antibiotics Administered Pre-surgically, Peri-operatively, and Post-operatively to Dogs that Survived with Septic Peritonitis

	Pre-Surgical	Peri-operative	Post-operative
Received Suitable Antibiotic	3/16=**18.8%**	12/16= **75.0%**	14/16= **87.5%**
Received Non-suitable Antibiotic	3/16= **18.8%**	2/16= **12.5%**	2/16=**12.5%**
No record of antibiotic administered	10/16=**62.5%**	2/16= **12.5%**	0/16=0= **0%**
No record and or non-suitable antibiotic administered	13/16= **81.3%**	4/16= **25.0%**	2/16= **12.5%**

Table 3. Percent of Suitable and Non-suitable Antibiotics Administered Pre-surgically, Peri-operatively, and Post-operatively to Dogs that Died with Septic Peritonitis

	Pre-Surgical	Peri-operative	Post-operative
Received Suitable Antibiotic	2/12= **16.7%**	6/12=**50.0%**	6/12=**50.0%**
Received Non-Suitable Antibiotic	5/12= **41.7%**	5/12=**41.7%**	3/12= **25.0%**
No record of Antibiotic Administered	5/12= **41.7%**	1/12=**8.3%**	2/12=**16.7%**
No record and or non-suitable antibiotic administered	10/12= **83.3%**	6/12=**50.0%**	5/12=**41.7%**

Table 4. Percent of Suitable Antibiotics Administered to 28 Dogs with Septic Peritonitis

	Pre-Surgical	Peri-operative	Post-operative
Survived	3/28=**10.7%**	12/28= **42.9%**	14/28=**50.0%**
Non Survivor	2/28=**7.1%**	6/28=**21.4%**	6/28=**21.4%**

Table 5. Percent of Non-suitable Antibiotics Administered to 28 Dogs with Septic Peritonitis

	Pre-Surgical	Peri-operative	Post-operative
Non Survivor	5/28=**17.9%**	5/28=**17.9%**	3/28= **10.7%**
Survivor	3/28=**10.7%**	2/28= **7.1%**	2/28=**7.1%**

Table 6. Percent of No Record of Antibiotics Administered and or Non-suitable Antibiotics Administered to 28 Dogs with Septic Peritonitis

	Pre-Surgical	Peri-operative	Post-operative
Non Survivor	10/28=**35.7%**	6/28= **21.4%**	5/28=**17.9%**
Survivor	13/28=**46.4%**	4/28=**14.3%**	2/28=**7.1%**

Table 7. Comparison of Survival between Dogs that did or did not Require Change of Antibiotics due to Bacterial Susceptibility

	No Change	Change
Survived	3/16=**18.8%**	11/16= **68.8%**
Non Survivor	2/12=**16.7%**	4/12=**33.3%**

No Change- Susceptible Antibiotic at all time points; Pre-surgical, Peri-operative, Post-operative
Change- Change from Non- suitable Pre-surgical and or Peri-operative Antibiotic to a Suitable Post-operative Antibiotic

Conclusion

The top three most common bacteria found in 28 cases of dogs with septic peritonitis were Escherichia coli followed by Enterococcus spp and then Streptococcus spp beta hemolytic.16/28 or 57.1% of cases with septic peritonitis resulted in survival while 12/28 or 42.9% of the cases with septic peritonitis resulted in death or euthanasia. When compared to previous literature these percentages are consistent with the typical survival rates.[8] 3/16 or 18.8% of the cases resulting in survival were administered a suitable antibiotic at all three time points. 2/12 or 16.7% of the cases resulting in death or euthanasia were given a suitable antibiotic at all three time points. These finding indicate that 5/28 cases or 17.9% of the time a suitable pre-surgical and peri-operative antibiotic was chosen by the veterinarian initially and 82.1% of the time a suitable antibiotic was not chosen initially. 15/28 or 53.6% of the dogs with septic peritonitis were not administered a suitable antibiotic pre and or peri-operatively and then were switched to a suitable post-operative antibiotic after the interoperative bacterial culture results were received. 11/15 or 73.3% of the cases which initially did not received a suitable antibiotic but were switched to a suitable post-operative antibiotic resulted in survival. These results indicate that although a non-suitable antibiotic or not antibiotic was administered initially, by changing to an antibiotic to which the offending bacteria is susceptible will increase survival rates.15/28 or 53.6% of dogs with septic peritonitis had no record of an antibiotic being administered pre-surgically. 10/15 or 66.7% of the cases that hard no record of antibiotics administered pre-surgically resulted in survival while 5/15 or 33.3% of the cases resulted in death or euthanasia. These findings indicate that administration of a suitable pre-surgical antibiotic alone does not dictate a higher survival rate. When a suitable pre-surgical and or peri-operative antibiotic is combined the results are altered; 18/28 or 64.3% of the dogs with septic peritonitis were administered a suitable antibiotic pre-surgically and or peri-operatively. 12/18 or 66.7% of the dogs that initially received a suitable antibiotic survived. 10/28 or 35.7% of the dogs with septic peritonitis were not administered a suitable antibiotic pre-surgically and or peri-operatively. 6/10 or 60.0% of the dogs that did not received a suitable antibiotic initially died or were euthanized. These findings indicate that when an antibiotic is administered pre-surgically and or peri-operatively to which the offending bacteria is susceptible then the survival rate of the dogs can be increased.
One limitations of this study is its retrospective nature, which all results are determined on accurate documentation in the medical records. This can be a particular source of error when determining the antibiotics administered throughout the hospital stay as well as what antibiotics that were administered by the referring veterinarian. Another limitation is the small number of cases of septic peritonitis containing interoperative bacterial cultures. The small population number will affect the statistical significance of the data collected. No statistical analysis has been performed to date.

References and Acknowledgements

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Footnotes: a. Martin, L. Surviving Sepsis, in Proceedings. 13th Annual Meeting of the Society of Veterinary Soft Tissue Surgery 2014:39-44.

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